

WHAT IS CLAIMED IS:

1. A silicon carbide-based, porous, lightweight, heat-resistant structural material produced by a process comprising the steps of:

preparing one of a porous structural body containing carbon which remains after the porous structural body is fired in an evacuated or an inert atmosphere and a porous structural body which is decomposed during firing in an evacuated or an inert atmosphere, each porous structure body having a framework which retains the shape of the porous structure body after firing, a slurry containing a resin used as a carbon source and powdered silicon, and molten silicon;

infiltrating the slurry into the porous structural body;  
carbonizing the porous structural body;

performing reaction-bonding of the porous structural body so as to form silicon carbide having superior molten silicon wettability and to simultaneously form open pores caused by the reaction-bonding during which the reaction volume decreases;  
and

infiltrating the molten silicon into the porous structural body.

2. A method for manufacturing a silicon carbide-based, porous, lightweight, heat-resistant structural material,

comprising the steps of:

preparing one of a porous structural body containing carbon which remains after the porous structural body is fired in an evacuated or an inert atmosphere and a porous structural body which is decomposed during firing in an evacuated or an inert atmosphere, each porous structure body having a framework which retains the shape of the porous structure body after firing, a slurry containing a resin used as a carbon source and powdered silicon, and molten silicon;

a step of infiltrating the slurry into the porous structural body;

a step of carbonizing the porous structural body at 900 to 1,350°C in an evacuated or an inert atmosphere;

a step of performing reaction-bonding of the porous structural body at 1,350°C or more in an evacuated or an inert atmosphere so as to form silicon carbide having a superior molten silicon wettability and to simultaneously form open pores caused by the reaction-bonding during which the reaction volume decreases; and

a step of infiltrating molten silicon into the porous structural body at 1,300 to 1,800°C in an evacuated or an inert atmosphere.

3. A method for manufacturing a silicon carbide-based, porous, lightweight, heat-resistant structural material,

according to Claim 2, wherein the porous structural body having the framework comprises one of paper, vegetal matter, cloth, and a porous plastic in the form of a sponge or a sheet.

4. A method for manufacturing a silicon carbide-based, porous, lightweight, heat-resistant structural material, according to one of Claims 2 and 3, wherein the resin infiltrated into the porous structural body having the framework comprises at least one selected from the group consisting of a phenolic resin, a furan resin, an organometallic polymer, and cane sugar.

5. A method for manufacturing a silicon carbide-based, porous, lightweight, heat-resistant structural material, according to Claim 3, wherein the paper comprises one selected from the group consisting of corrugated cardboard and cardboard, the vegetal matter comprises one selected from the group consisting of wood, straw, and bamboo, and the cloth comprises one selected from the group consisting of woven cloth and non-woven cloth.